MDDC - 987

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ATOMIC ENERGY COMMISSION
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184" CYCLOTRON
SYNCHROSCOPE BEAM PICTURES ON TWO PROBES

by

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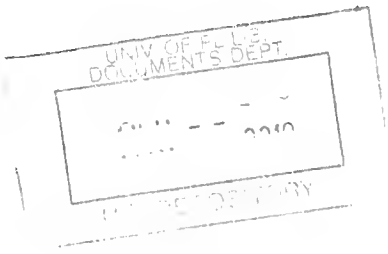

Date of Manuscript: February 26, 1947

Document Declassified: May 26, 1947

This document consists of 4 pages.

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By Fred W. Yeater, Jr.

Experiment done by Fred W. Yeater, Jr., Ralph Dufour, Albert Oliver

INTRODUCTION

The described experiment was performed in an effort to determine more definitely that the peaks, or "pips," shown in synchroscope photographs of the beam current are caused by precession of the beam.

EXPERIMENTAL SETUP

An auxiliary copper probe, shielded for RF pickup, was introduced into the main vacuum tank through a Wilson seal on the port near the ion source in such a manner as to generate a 155° angle with the regular probe. (See Figure 1.) This auxiliary probe was made adjustable as to its radial depth, and equipped to supply a beam signal to the synchroscope in addition to that signal supplied by the regular probe.

Several photographs were taken in the usual manner under the following conditions:

Magnet current	1500 amp
Dee voltage (RF)	16 kv
Capacitor speed	240 rpm
Pulse length	5 microsec.

RESULTS

The usual beam pattern of two to three pips was obtained at several probe radii; namely, 22", 28 1/2" and 35". Then, when the auxiliary probe was positioned to catch some of the accelerated ions, the beam pattern was altered to show the relative amplitudes of beam current in the two probes and the phase relation of those currents.

This effect is shown most clearly in those photographs numbered 11 to 14, inclusive. (There were five additional photographs to complete this series which unfortunately do not exist due to camera trouble.)

Following is a brief description of the photographs. Operating values are as listed previously and the regular probe radius was 28 1/2".

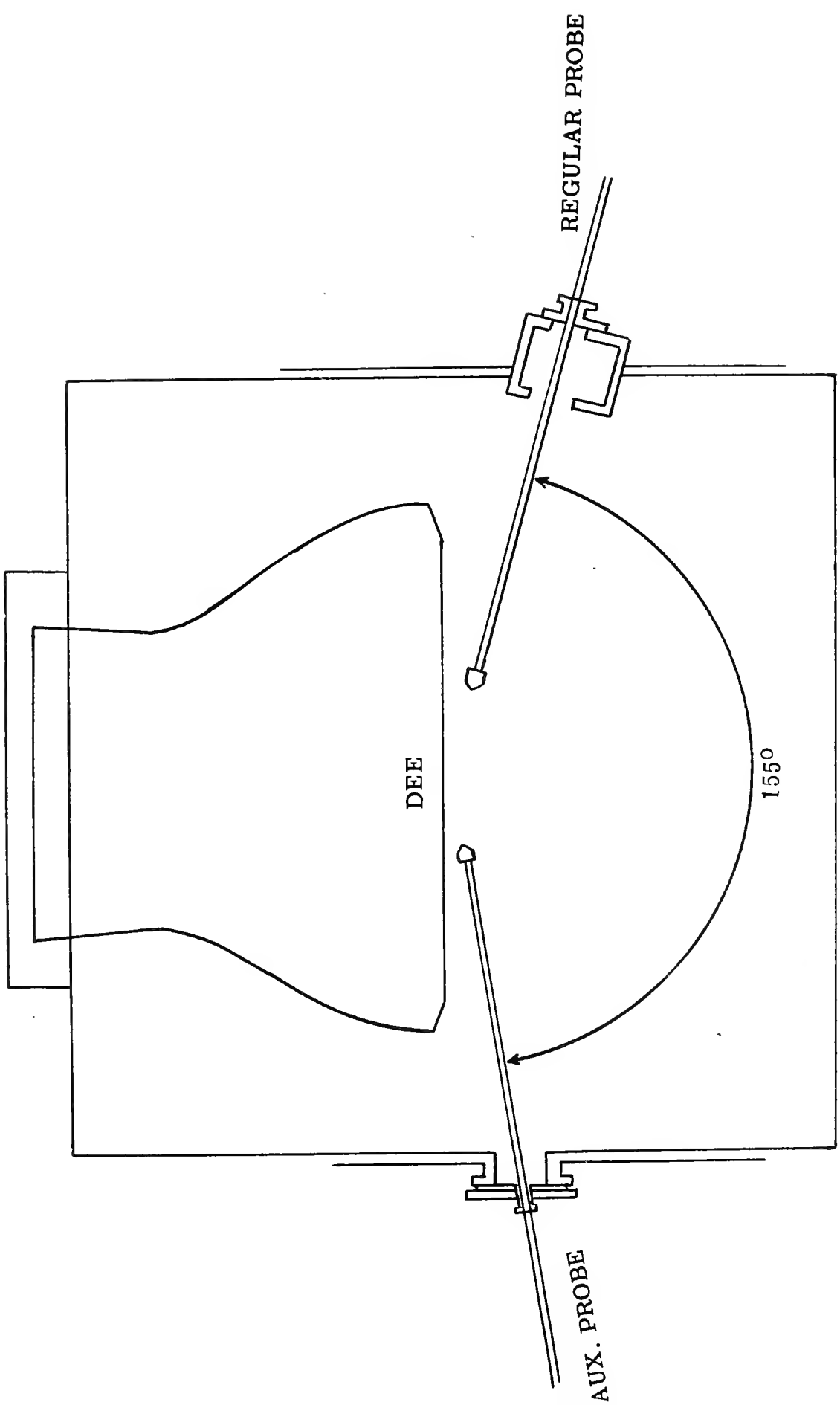

Figure 1

Photograph No. 11: Auxiliary probe radius 28 1/4"
Beam current .55 x 10^{-7} amp
This photograph shows the beam to be occurring 180 microseconds after the arc pulse (10 microsecond markers).

Photograph No. 12: Same conditions as above, but with expanded synchroscope sweep showing the beam to be 25 microseconds in width.

Photograph No. 13: Auxiliary probe radius 27 13/16"
Beam current .35 x 10^{-7} amp
The pips produced by the auxiliary probe are readily apparent, as is the drop in beam current amplitude.

Photograph No. 14: Auxiliary probe radius 27 9/16"
Beam current .25 x 10^{-7} amp
Beam current is more equally divided between the two probes, and the phase relationship between these currents is more apparent.

Note: In all the above photographs, the beginning of the synchroscope sweep was triggered at a point on the RF cycle corresponding to a frequency of 11.06 mc.

The remainder of this series would have shown the pips produced by the regular probe to drop in amplitude while those produced by the auxiliary probe increased proportionately as the radius of the auxiliary probe was decreased, until such time as the auxiliary probe was catching essentially all the ions. At this time the pattern was a series of triangular vanes of equal amplitude. This pattern actually changed very little, if any, from that point where the current distribution was equal to the point where all the current was on the auxiliary probe. The logical end result would have been a pattern similar to the original, shown in Photograph No. 12, with a 155° phase shift.

Photograph No. 11

Photograph No. 12

Photograph No. 13

Photograph No. 14